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Oxford Knee Score: cross-cultural adaptation and validation of the Turkish version in patients with osteoarthritis of the knee

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Objective: The Oxford Knee Score (OKS) is a valid, short, self-administered, and site- specific outcome measure specifically developed for patients with knee arthroplasty. This study aimed to cross-culturally adapt and validate the OKS to be used in Turkish-speaking patients with osteoarthritis of the knee.

Methods: The OKS was translated and culturally adapted according to the guidelines in the literature. Ninety-one patients (mean age: 55.89±7.85 years) with knee osteoarthritis participated in the study. Patients completed the Turkish version of the Oxford Knee Score (OKS-TR), Short-Form 36 Health Survey (SF-36), and Western Ontario and McMaster Universities Index (WOMAC) questionnaires. Internal consistency was tested using Cronbach's α coefficient. Patients completed the OKS-TR questionnaire twice in 7 days to determine the reproducibility. Correlation between the total results of both tests was determined by Spearman's correlation coefficient and intraclass correlation coefficients (ICC). Validity was assessed by calculating Spearman's correlation coefficient between the OKS, WOMAC, and SF-36 scores. Floor and ceiling effects were analyzed.

Results: Internal consistency was high (Cronbach's α: 0.90). The reproducibility tested by 2 different methods showed no significant difference ($p>0.05$). The construct validity analyses showed a significant correlation between the OKS and the other scores ($p<0.05$). There was no floor or ceiling effect in total OKS score.

Conclusion: The OKS-TR is a reliable and valid measure for the self-assessment of pain and function in Turkish-speaking patients with osteoarthritis of the knee.

Keywords: Clinical assessment; functional status; knee osteoarthritis; Oxford Knee Score; questionnaires.

Level of Evidence: Level II, Diagnostic study.

Osteoarthritis (OA) is the most common joint disease in the adult population globally,[1] and OA of the knee is the most common form of arthritis. The age- and sex-standardized annual incidence rate for knee OA is 240/100,000 persons.[2,3] Although the incidence studies are limited in Turkey, the prevalence of symptom-

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atic knee OA in the urban region of southern Turkey was determined as 14.8% (female 22.5%, male 8%) in the population aged 50 years or over.[4] OA is characterized by pain during walking, sitting, standing, and stair climbing, and it eventually results in decreased physical ability. As OA progresses, pain becomes constant, joint functions are seriously damaged, and all aspects of activities of daily living (self-care, work, social, and leisure time activities) are negatively affected.[1,5–7] Developed by Dawson and colleagues, the Oxford Knee Score (OKS) is a short patient-reported outcome measure to evaluate physical function and pain in patients with total knee replacement.[8] OKS is accepted as one of the most reliable, valid, and responsive patient-assessed, knee-specific questionnaires.[9] This questionnaire has also been used in patients with viscosupplementation,[10–12] osteotomy,[13] tibia plateau fracture,[14] and osteoarthritis.[7,15] OKS has been validated in several languages with good reliability, including, Swedish,[16] Italian,[17] Thai,[18] Dutch,[19] Chinese,[20] German,[7] French,[21] Japanese,[10] Portuguese,[22] Korean,[23] and Persian.[6]

Considering the high prevalence of OA in our region, the aim of this study was to cross-culturally adapt the OKS for Turkish-speaking patients and to determine the clinometric properties, reliability, and validity of the Turkish version of the OKS (OKS-TR) in patients with OA of the knee.

Patients and methods

Ninety-one patients with knee OA who were evaluated in Hacettepe University Department of Orthopedics and Traumatology were recruited to the study. All patients met the clinical and radiological criteria of the American College of Rheumatology for primary knee OA.[24] Disease severity was graded on the basis of the Kellgren and Lawrence radiographic score system.[25] Exclusion criteria were rheumatic diseases potentially responsible for a secondary OA, severe articular inflammation, and traumatic knee lesions. Patients with cardiac diseases or peripheral vascular diseases were also excluded. All patients were native Turkish speakers. The study protocol was approved by the local research and ethics committee of Hacettepe University. Informed consent was obtained from each patient prior to participation.

Demographic characteristics of patients were recorded. All patients received and completed the following questionnaires: OKS-TR, Turkish version of Western Ontario and McMaster Universities Arthritis Index (WOMAC),[26] and Turkish version of the Short-Form 36 Health Survey (SF-36).[27]

The OKS is a 12-item questionnaire which is practical, sensitive to clinically important changes, reliable, and valid.[8,9] Each question has 5 categories of response, corresponding to a score of 0 to 4. Overall score ranges from 0 (worst) to 48 (best), and the revised version was used for scoring.[28]

Patients completed all questionnaires at the first interview. The retest was conducted by telephone interview 7 days after the first test.[29] The time period required to answer the questions was noted during application of the first OKS questionnaire. Comprehensibility and acceptance of the questionnaire was determined by the ratio of unanswered questions. Upon completion of the OKS, the SF-36 and WOMAC questionnaires were also completed by all patients.

The SF-36 consists of 8 subscales (physical functioning, physical role, bodily pain, general health, vitality, social functioning, emotional role, mental health) to evaluate the general health, functional status, and well-being of the patients. Scores for each subscale range from 0 (poor) to 100 (good health).[27,30]

The WOMAC, a 24-item disease-specific functional measurement, consists of 3 subscales: pain (5 items), stiffness (2 items), and physical function (17 items). The 5-point Likert (0 to 4) WOMAC was used in this study. Subscale scores were calculated by summing each item for pain score, stiffness, and physical function. Total score was calculated by summing the 3 subscales scores (range: 0–96), with higher scores reflecting worse pain, stiffness, and physical function.[26]

The OKS-TR was developed according to the international guidelines under the license of the OKS copyright holder (©Isis Innovation Limited, 1998. All rights reserved).[31–33] Two translations from English to Turkish were performed by 2 different independent translators whose native language was Turkish and who were fluent in English, allowing detection of errors and divergent interpretations of items in the original instrument with ambiguous meanings. To obtain better idiomatic and conceptual (rather than literal) equivalence between the 2 versions of the questionnaire and to render the intended measurements more reliable, 1 translator had knowledge of the study purpose and the concepts of the instrument. The other translator was unaware of the translation objective, which was useful for identifying incorrect changes from the original questionnaire. Both Turkish translations were then merged by these translators and 2 bilingual health professionals and retranslated back to English by 2 native English speakers who were blinded to the original version. Each English translation was then compared with the original English OKS version and checked for inconsistencies. To assess

the necessity of performing a cultural adaptation and to ensure its accuracy for use among Turkish-speaking patients, the Turkish version was jointly reviewed by an expert committee composed of the authors, 2 experienced professional translators, and 2 health professionals, all of whom were bilingual. To detect errors of interpretation and nuances that might have been missed, the committee again compared the Turkish version with the original English version. The final stage of the adaptation process was to test the pre-final version. Pretesting of the pre-final Turkish version for comprehensibility on 10 randomly selected patients revealed no further difficulties with the questionnaire. After this testing on a limited number of patients, the questionnaire was approved by the translation committee to be used on the study population.[29,31,32,34]

The sample size was based on Altman's recommendation of at least 50 subjects in a methods comparison study.[35] Quantitative and qualitative variables were presented as mean±standard deviation (Mean±SD) and percent (%), respectively. Minimum and maximum scores for individual items and the total score for the OKS were examined for possible floor or ceiling effects. If more than 15% of respondents achieved the lowest or highest possible score, floor or ceiling effects were considered to be present. Statistical analyses were performed using SPSS software (version 11.5, SPSS Inc., Chicago, IL, USA). Values of $p<0.05$ were considered significant.

The Cronbach's coefficient α was used to measure internal consistency. The Cronbach's α statistic is an estimate of the reliability of a scale's measurement calculated from a single administration of the scale. The coefficient was also calculated by elimination of 1 item from all 12 questions. All items were examined for correlation with the overall score.[29,35–38]

Intraclass correlation coefficient (ICC) was another measurement tool used to assess reliability. Several forms of ICC exist. A 2-way random effects model single measure reliability analyses was used in the present study. ICC was calculated with confidence intervals for each item and total score.[29,35,36,39] Reproducibility and test-retest reliability were assessed by asking patients to complete the OKS-TR again 7 days later. The change in mean scores between the test and retest was calculated. Differences between test and retest scores were compared by paired t-test to assess any systematic differences between the 2 tests. Correlation between the results of both tests was determined by Spearman's correlation coefficient to analyze reproducibility.[35,36,39]

Table 1. Demographic and clinical characteristics of study population (n=91).

	n	%	Mean±SD	Range
Age (years)			55.89±7.85	38–83
Duration of osteoarthritis (months)			17.45±16.61	1–108
Body mass index (kg/cm^2)			29.68±3.41	20.86–40.29
Gender				
Female	62	68.1		
Male	29	31.9		
Marital status				
Married	84	92.3		
Single	7	7.7		
Education				
University or higher degree	2	2.2		
High school	27	27.9		
Middle school	18	19.8		
Primary school	44	50.1		
Affected knee				
Right	35	38.5		
Left	8	8.8		
Bilateral	48	52.7		
Radiological grade				
Grade 1	6	6.6		
Grade 2	56	61.5		
Grade 3	26	28.6		
Grade 4	3	3.3		

Validity is an index of how well a test measures what it is supposed to measure. Validity was assessed by calculating Spearman's correlation coefficient between the OKS-TR and the WOMAC and SF-36. Spearman's correlations were used due to the nonparametric nature of the data. To evaluate the convergent validity of the OKS-TR, Spearman's correlation coefficients were calculated between the OKS-TR and radiological score, as well as between the WOMAC scores and related subscores of the SF-36. Discriminant validity was evaluated by calculating Spearman's correlation coefficients between the OKS and SF-36 mental component summary, mental health, and general health subscores. Higher correlation coefficients are expected for convergent validity, and lower correlation coefficients are expected for discriminant validity.[16,29,35,36,39]

Results

A total of 91 patients fulfilled the inclusion criteria and participated in the study. After clinical evaluation, all pa-

Table 2. Absolute values of all scores.

	Scores	
Instruments	**Mean±SD**	**Range**
OKS-TR (First test)	21.13±6.40	8–34
OKS-TR (Retest)	21.61±6.51	7–34
WOMAC		
Total	14.07±4.09	6.23–24.48
Pain	10.91±2.89	6–18
Stiffness	2.76±1.64	0–7
Function	35.84±7.73	17–56
SF-36		
Physical functioning	23.68±13.57	0–70
Pain	32.57±9.53	10–51
Vitality	45.09±11.45	20–90
Emotional role	18.68±37.58	0–100
Physical role	11.26±26.68	0–100
Social functioning	60.16±20.82	25–100
Mental health	51.37±9.55	32–96
General health	29.04±15.62	0–82
Physical component summary	26.70±4.77	17–44.20
Mental component summary	41.60±6.64	30.90–71.80

SD: Standard deviation; OKS-TR: Turkish version of Oxford Knee Score; WOMAC: Western Ontario and McMaster Universities Arthritis Index; SF-36: Short-Form 36 Health Survey.

Table 3. Internal consistency of Turkish version of the Oxford Knee Score.

OKS-TR items	Mean±SD	Variance	Corrected item-total correlation	Alpha if item removed
1	0.64±0.54	38.52	0.33	0.91
2	2.62±1.00	32.85	0.62	0.90
3	1.75±0.70	35.28	0.63	0.90
4	1.82±0.86	34.64	0.56	0.90
5	1.75±0.62	35.66	0.68	0.89
6	1.91±0.79	33.66	0.73	0.89
7	1.36±0.85	33.42	0.70	0.89
8	1.84±0.81	33.45	0.74	0.89
9	1.60±0.66	35.52	0.65	0.90
10	2.07±0.76	34.94	0.61	0.90
11	2.00±0.81	33.74	0.70	0.89
12	1.71±0.63	36.09	0.60	0.90

OKS-TR: Turkish version of the Oxford Knee Score; SD: Standard deviation.

tients completed the questionnaires. The demographic and clinical characteristics of the study population are presented in Table 1. Comprehensibility and acceptance of the questionnaire as determined by the ratio of unanswered questions was good, as there were no unanswered questions. Patients did not report any difficulties in understanding and completing the OKS-TR. The Turkish translation of OKS is presented in Appendix 1. Mean time for completing the OKS-TR was 4 min 42 s (range: 2 min 13 s to 7 min 24 s). The absolute values of all scores are presented in Table 2.

The internal consistency of OKS-TR tested by

Appendix 1. Dizinizle ilgili problemler.

Geçen 4 hafta boyunca.....				✓her soru için tek bir kutu işaretleyin.
1. Dizinizde genellikle olan ağrıyı nasıl tarif edersiniz?				
Yok	Çok hafif	Hafif	Orta	Şiddetli
❑	❑	❑	❑	❑
2. Yıkanırken ve kurulanırken (tüm vücudunuzu) diziniz nedeniyle hiç sıkıntınız oldu mu?				
Hiçbir sıkıntı yok	Çok az sıkıntı	Orta düzeyde sıkıntı	Aşırı zorlanma	Yapmak imkansız
❑	❑	❑	❑	❑
3. Arabaya binip inerken ya da toplu taşıma araçlarını kullanırken diziniz nedeniyle hiç sıkıntınız oldu mu? *(hangisini daha sık kullanıyorsanız)*				
Hiçbir sıkıntı yok	Çok az sıkıntı	Orta düzeyde sıkıntı	Aşırı zorlanma	Yapmak imkansız
❑	❑	❑	❑	❑
4. Dizinizdeki ağrı şiddetlenmeden önce ne kadar süre yürüyebildiniz? *(bastonlu veya bastonsuz)*				
Ağrı yok/30 dakikadan fazla	16–30 dakika	5–15 dakika	Sadece evin etrafında	Hiç-yürüyüşte ağrı şiddetli
❑	❑	❑	❑	❑
5. Yemekten sonra (masada oturarak) diziniz nedeniyle ayağa kalkmak ne kadar ağrılı oldu?				
Ağrılı değil	Hafif ağrılı	Orta şiddette ağrılı	Çok ağrılı	Dayanılmaz
❑	❑	❑	❑	❑
6. Yürüken diziniz nedeniyle topalladınız mı?				
Nadiren/hiç	Bazen veya sadece başlangıçta	Sıklıkla, sadece başlangıçta değil	Çoğu zaman	Her zaman
❑	❑	❑	❑	❑
7. Diz çöküp tekrar kalkabildiniz mi?				
Evet kolaylıkla	Hafif zorlanmayla	Orta düzeyde zorlanmayla	Aşırı zorlanmayla	Hayır mümkün değil
❑	❑	❑	❑	❑
8. Gece yatakta dizinizdeki ağrı nedeniyle sıkıntınız oldu mu?				
Hiçbir gece	Sadece 1-2 gece	Bazı geceler	Çoğu geceler	Her gece
❑	❑	❑	❑	❑
9. Dizinizdeki ağrı günlük işlerinizi (ev işleri dahil) ne kadar etkiledi?				
Hiç	Biraz	Orta düzeyde	Epeyce	Tamamen
❑	❑	❑	❑	❑
10. Diziniz aniden boşalacakmış veya bükülecekmiş gibi hissetiniz mi?				
Nadiren/hiç	Bazen veya sadece başlangıçta	Sıklıkla, sadece başlangıçta değil	Çoğu zaman	Her zaman
❑	❑	❑	❑	❑
11. Ev alışverişlerini kendiniz yapabildiniz mi?				
Evet kolaylıkla	Hafif zorlanmayla	Orta düzeyde zorlanmayla	Aşırı zorlanmayla	Hayır mümkün değil
❑	❑	❑	❑	❑
12. Bir kat merdiven inebildiniz mi?				
Evet kolaylıkla	Hafif zorlanmayla	Orta düzeyde zorlanmayla	Aşırı zorlanmayla	Hayır mümkün değil
❑	❑	❑	❑	❑

Table 4. Correlation between OKS and radiological score, WOMAC, and SF-36.

Instrument	OKS
OKS-TR (retest)	0.978*
Radiological score	–0.571*
WOMAC	
Total	–0.839*
Pain	–0.807*
Stiffness	–0.656*
Function	–0.861*
SF-36	
Physical component summary	0.573*
Mental component summary	0.194
Physical functioning	0.634*
Pain	0.649*
Vitality	0.250**
Emotional role	0.289*
Physical role	0.368*
Social functioning	0.428*
Mental health	–0.048
General health	0.174

OKS-TR: Turkish version of the Oxford Knee Score; WOMAC: Western Ontario and McMaster Universities Index; SF-36: Short-Form 36 Health Survey. *Correlation p<0.001; **Correlation p<0.05.

Cronbach's α was high for the total score (Cronbach's α 0.90). Corrected item-total correlations ranged between 0.33–0.74. All items correlated with the total score, and on elimination of 1 item from the original list, analysis using the remaining 12 items did not result in α higher than 0.90 (Table 3).

All patients completed the OKS-TR twice to test the reproducibility. The second test was administered 7 days after the first test via telephone interview because the postal return rate for the Turkish population is low. The mean difference between both tests was −0.20 (SD=1.09; 95% confidence interval −0.44 to 0.03), which was not statistically significant (p>0.05). Spearman's correlation coefficient between the 2 tests was high (r=0.978, p<0.0001) (Table 4). The correlation between the OKS-TR and radiological score was also high (r=−0.571, p<0.001) (Table 4).

For each item, ICC was used to analyze test-retest reliability. The ICC values were very high, ranging between 0.87 and 1.00 (Table 5).

There were floor (score=0) and ceiling (score=4) effects in 2 items. The floor effect was observed in item 1 (38.5%), and the ceiling effect was observed in item 2 (26%). There was no floor or ceiling effect for total OKS-TR score.

With respect to convergent validity, there were significant correlations between the OKS-TR and WOMAC pain, stiffness, and function scores, and SF-36 pain, physical functioning, physical component summary, social functioning, physical role, emotional role, and vitality scores. The highest degree of correlation was observed with the SF-36 pain score (r=0.649, p<0.0001) (Table 4).

There were no significant correlations between the OKS-TR and mental component summary, mental health, and general health sub-scores of the SF-36 (Table 4).

Discussion

The present study demonstrated that the OKS-TR is a valid and reliable tool for the assessment of pain and

Table 5. Test-retest scores of the Turkish version of the Oxford Knee Score to evaluate reliability of patients with osteoarthritis of the knee.

Turkish version of Oxford Knee Score items	First test	Second test	ICC (95% CI)
	Mean±SD	Mean±SD	
Total Score	21.13±6.40	21.61±6.51	0.99 (0.98–0.99)
Turkish version of Oxford Knee Score 1	0.64±0.54	0.72±0.47	0.87 (0.80–0.91)
Turkish version of Oxford Knee Score 2	2.62±1.00	2.69±1.00	0.97 (0.96–0.98)
Turkish version of Oxford Knee Score 3	1.75±0.70	1.81±0.72	0.95 (0.92–0.96)
Turkish version of Oxford Knee Score 4	1.92±0.86	1.85±0.86	0.95 (0.93–0.97)
Turkish version of Oxford Knee Score 5	1.75±0.62	1.76±0.63	0.97 (0.96–0.98)
Turkish version of Oxford Knee Score 6	1.91±0.79	1.98±0.78	0.97 (0.95–0.98)
Turkish version of Oxford Knee Score 7	1.36±0.85	1.42±0.81	0.97 (0.96–0.98)
Turkish version of Oxford Knee Score 8	1.84±0.81	1.86±0.79	0.98 (0.97–0.98)
Turkish version of Oxford Knee Score 9	1.60±0.66	1.67±0.73	0.95 (0.94–0.97)
Turkish version of Oxford Knee Score 10	2.07±0.76	2.06±0.75	0.97 (0.96–0.98)
Turkish version of Oxford Knee Score 11	2.00±0.81	2.00±0.81	1.00 (1.00–1.00)
Turkish version of Oxford Knee Score 12	1.71±0.63	1.73±0.61	0.98 (0.97–0.99)

ICC: Intraclass correlation coefficients; SD: Standard deviation.

function in Turkish-speaking patients with knee osteoarthritis.

OKS is specifically designed to evaluate quality of life and pain perception in total knee replacement patients.[8] We believe that translating and culturally adapting this kind of instrument into Turkish is important not only for use in Turkey but also for use in other countries in which there are Turkish-speaking people. The Turkish population in European Union countries currently stands at 10 million.[40] The acceptance and short time needed to complete the questionnaire suggests that the OKS-TR is well understood by Turkish mother-tongued patients. In addition, the evaluation of the questionnaire by researchers confirms that the OKS-TR is similar to the original English OKS, in that it is a practical and easily assessed tool.[8,29]

As demonstrated by the internal consistency (Cronbach's α 0.90), test-retest reliability ($r=0.98$), and the non-significant difference between the first test and second test scores ($p>0.05$), the psychometric properties of the OKS-TR are in accordance with the original English, German, Italian, Dutch, Swedish, Portuguese, Persian, French, Korean, Japanese, and Singaporean Chinese versions.[6–8,10,16,17,19,21–23] Although there are slight differences in the psychometric properties of these test versions, the differences could be related to demographic and clinical differences between the study populations. When compared to studies of the other versions, our study population was younger, the disease duration was shorter, and the majority of the patients were only moderately affected.

ICC was analyzed in studies of all versions of OKS. The results of the present study are comparable with those of previous studies of other versions, indicating that our translation and cultural adaptation succeeded in establishing equivalent meaning for each item.[6–8,10,16,17,19–23]

Agreement parameters may be overestimated when floor and ceiling effects exist, since an extreme value of an item is more likely to be identical on the retest.[29,41] Responsiveness will be limited because changes cannot be measured in such a case. In the present study, the OKS-TR showed floor and ceiling effects in 2 items, in concordance with the Persian version.[6] The heterogeneity in severity of OA in our patients might have caused this effect, as the majority of our patient population had grade 1 or grade 2 radiological scores, indicating less severe disease. Only approximately 32% of the patients had grade 3 or grade 4 involvement. However, there were no signs of floor or ceiling effects in the total score of the OKS-TR. This result supported the use of the OKS-TR questionnaire to measure changes in prospective studies.

The OKS-TR correlated well with radiological scores, WOMAC, and related SF-36 scores. With respect to discriminant validity, the OKS-TR was not correlated with the mental component summary, mental health, and general health sub-scores of the SF-36. Although our findings are in agreement with studies of the original and the previous versions, the variability of SF-36 correlations among the studies is remarkable.[6–8,10,16,17,19–23] This variability may be attributed to either the cultural differences or to the variability in the severity of OA. Therefore, when comparing questionnaires across clinical studies which are performed in different countries, differences in socio-cultural factors, healthcare systems, and severity of the disease should be considered.[16]

In conclusion, the Turkish translation of the OKS is culturally and linguistically equivalent to the original English version. The results of this study support the use of the OKS-TR as a reliable and valid outcome instrument in Turkish-speaking patients with knee OA.

Conflicts of Interest: No conflicts declared.

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